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Linking water resources to food security through virtual water

Stefania Tamea

Politecnico di Torino, Department of Environment, Land and Infrastructure Engineering, Torino, Italy
(stefania.tamea@polito.it)

The largest use of global freshwater resources is related to food production. While each day we drink about 2 liters of water, we consume (eating) about 4000 liters of “virtual water”, which represents the freshwater used to produce crop-based and livestock-based food. Considering human water consumption as a whole, most part originates from agriculture (85.8%), and only minor parts come from industry (9.6%) or households (4.6%). These numbers shed light on the great pressure of humanity on global freshwater resources and justify the increasing interest towards this form of environmental impact, usually known as “water footprint”.

Virtual water is a key variable in establishing the nexus between water and food. In fact, water resources used for agricultural production determine local food availability, and impact the international trade of agricultural goods. Trade, in turn, makes food commodities available to nations which are not otherwise self-sufficient, in terms of water resources or food, and it establishes an equilibrium between food demand and production at the global scale. Therefore, food security strongly relies on international food trade, but also on the use of distant and foreign water resources, which need to be acknowledged and investigated. Virtual water embedded in production and international trade follows the fate of food on the trade network, generating virtual flows of great magnitude (e.g., 2800 km³ in 2010) and defining local and global virtual water balances worldwide.

The resulting water-food nexus is critical for the societal and economic development, and it has several implications ranging from population dynamics to the competing use of freshwater resources, from dietary guidelines to globalization of trade, from externalization of pollution to policy making and to socio-economic wealth. All these implications represent a great challenge for future research, not only in hydrology but in the many fields related to this interdisciplinary topic. Virtual water and water footprint accounting provide the tools for understanding such implications and to describe, quantify, and investigate the inextricable link existing between water resources and food security.